United States Department Of Agriculture | Forest Service | Shasta-Trinity National Forests

88-27 #7

Reply To: 3420 Lat 40.40794 Lon -123.41016 Date: November 14, 1988

Subject: Biological Evaluation of Douglas-fir Mortality in Hidden Valley X Plantation, Hayfork Ranger District

To: District Ranger, Hayfork Ranger District

On November 7, 1988, David Schultz, entomologist, and I visited the Hayfork Ranger District at the request of Mike Birch and Ann Rourke. They had observed mortality of Douglas-fir in a plantation which they were considering for thinning and requested an evaluation of the cause.

The plantation is the Hidden Valley X unit (T. 1 S., R. 7 E., section 5). It is 22 acres and was planted with Douglas-fir in 1972. The present size classes are sapling and small poles. A 1979 stocking survey identified about 450 trees per acre. Site class is an estimated Dunning 3.

During a reconnaissance survey in the plantation, older and more recent mortality of Douglas-fir was observed. Much of the mortality was in groups. These were spread along a skid trail which remained from the previous harvesting.

The above ground symptoms we observed--a stress crop of cones, thinning and yellowing of foliage, reduced leader growth--suggested black stain root disease, caused by Leptographium wageneri. When we examined the base of several trees, we found a black staining of the wood which followed the annual rings and which is typical of the root disease. In some affected trees, there was also a bluish-gray resin streaming from the base, another symptom occasionally found with black stain root disease.

In addition to the root disease, some trees had bole cankers which were causing branch flagging and top-killing. These cankers are rather common on Douglas-fir this year because of the stress caused by the lack of moisture. Several causes are possible, but a fungus, Phomopsis sp., has been a common associate. There is some local damage associated with this canker, but most trees will recover once soil moisture returns to normal.

The fungus, L. wageneri, has several strains which attack a number of hosts. The strain on Douglas-fir is specific to this host and is not known to attack other tree species. The fungus occurs in the roots and lower boles of infected trees. It occupies the vascular tracheids in the sapwood, blocking water transport. Several root-inhabiting insects are implicated as vectors, primarily a bark beetle, Hylastes nigrinus, and a weevil, Steremnius carinatus. These insects feed and breed in the phloem and cambium on roots of cut and declining Douglas-firs. Phloem may be suitable for attack for 2 years after tree death. It is believed that the fungus sporulates in the insect galleries and emerging

adults pick up the spores on their body. The fungus is then transmitted to another site when these adults feed on or breed in new roots. Once established in a root, the fungus grows through the tracheids and can attack the roots of surrounding Douglas-firs by growing across root contacts or for short distances through soil. Disease centers may continue to expand until there is a break in the root contacts, such as by a non-susceptible species, a road, or a stream.

There is no known method of directly controlling this disease once it is established in a stand. Neither is it known what conditions actually cause the initiation of new centers. There is some evidence that precommercial thinning is associated with increased incidence of black stain root disease, especially where previous harvesting was done with a tractor. It is not known if the presence of the disease in a stand prior to thinning influences the occurrence of additional infections following thinning.

## MANAGEMENT ALTERNATIVES

1. No Action. Mortality of Douglas-fir will continue within and around existing root disease centers. Some trees within centers may escape infection, but most of the site with root disease will not produce merchantable trees. The centers will increase in size and some may coalesce. It is possible that additional disease centers will occur as trees weakened by competition become attractive to the insect vectors. We cannot predict the extent of this type of activity. It is expected that the impact of the disease will decrease as the plantation reaches age 25-30 years. Mortality from overstocking combined with attacks of the Douglas-fir engraver, Scolytus unispinosus, and the fir flatheaded borer, Melanophila drummondi, will reduce the number of trees per acre, although stocking will be variable throughout the plantation.

2. Precommercial Thinning. Most of the trees in the plantation should respond positively to the decreased competition. The root diseased areas would probably not benefit because of the existing lower stocking level and the direct effects of the disease on tree growth. The rate of localized tree to tree spread of the root disease may decrease in a few years as the roots of removed trees deteriorate and become less suitable for the fungus. As the roots of healthy leave trees occupy this space, however, further spread is likely.

It is probable that the creation of stumps and newly killed root systems throughout the plantation will attract the insects that are vectors of the fungus. A small percentage of these may carry the fungus. Because of the amount of disease in the plantation, it is probable that a larger percentage of the insects attracted will carry and transmit the fungus than might occur in areas where the level of the disease is less. Therefore, it is likely that new infection centers in other parts of the plantation will occur following thinning.

3. Remove Trees from Root Disease Centers. Root disease centers would be identified on the ground based on above ground symptoms. A buffer strip of 75 feet around each center would also be identified. All Douglas-firs in the root disease centers and surrounding buffers would be removed. The larger openings created could be planted with a non-susceptible species, such as ponderosa

pine. This is not a control method as much as it is an attempt to return the site to productivity.

The effectiveness of creating buffers in Douglas-fir to stop further local spread of black stain root disease has not been demonstrated. It is possible that the fresh stumps created in the buffer may attract insect vectors and introduce the fungus into the edge of the buffer near the residual stand, with subsequent spread of the disease into the stand. Any attempts at this technique should be considered experimental and I would suggest the involvement of Forest Pest Management personnel to help monitor the efficacy of treatment.

4. Slash Treatment. Implementing alternatives 2 or 3 would create large amounts of green Douglas-fir slash with stems greater than 3 inches diameter. This material could be used by the Douglas-fir engraver for breeding. Engraver beetles emerging from a concentration of slash could attack and kill some of the residual stand. Little is known about the life cycle of this beetle except that it apparently completes two generations during the summer. Unless the slash is scheduled to be burned within about 6 weeks after cutting, it would probably be safest to restrict large thinning or clearing projects to the period from July through December. Lopping of slash over 3 inches diameter and scattering the slash in sunny areas should also reduce breeding success by the Douglas-fir engraver.

If there are any questions about this report or the displayed alternatives, or you would like additional assistance, please contact me at (916)246-5101.

/s/ Gregg A. DeNitto

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